CLAIMS

We claim:

1. An optoelectronic transceiver, comprising:

a receive optical subassembly;

a postamplifier in communication with the receive optical subassembly;

a transmit optical subassembly that includes an optical transmitter; and

a driver in communication with the transmit optical subassembly and comprising:

an input;

an output; and

an operational amplifier configured to communicate with the transmit optical subassembly by way of the output, and comprising:

a first stage including a differential amplifier configured to receive a reference voltage input and an optical transmitter voltage input and having transconductance that increases exponentially as a difference between the reference voltage and the optical transmitter voltage increases, wherein the differential amplifier generates an output current based on the input, the optical transmitter voltage representing an optical output strength of the optical transmitter, the reference voltage corresponding to a desired magnitude of the optical transmitter voltage;

a second stage including a capacitor, the second stage integrating the output current to generate a first output voltage; and

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a third stage including an output buffer, the third stage configured to receive as input the first output voltage to generate a second output voltage approximately equal to the first output voltage, the second output voltage controlling a bias current for the optical transmitter.

2. The optoelectronic transceiver as recited in claim 1, wherein:

the differential amplifier comprises a first transistor, a second transistor, a third transistor, a fourth transistor, a fifth transistor, and a sixth transistor;

a base of the first transistor is connected to the optical transmitter voltage, a collector of the first transistor transmits a first current to a current mirror, and the emitter of the first transistor is connected to a base of the second transistor, a first current source, and an emitter of the third transistor;

a collector of the second transistor is connected to a power supply voltage and an emitter of the second transistor is connected to a base of the fourth transistor and a second current source;

a collector of the third transistor is connected to ground and a base of the third transistor is connected to a third current source and an emitter of the fifth transistor;

a collector of the fourth transistor is connected to the ground and an emitter of the fourth transistor is connected to a fourth current source, a base of the fifth transistor, and an emitter of the sixth transistor;

a collector of the fifth transistor is connected to the power supply voltage;

a base of the sixth transistor is connected to the reference voltage and a collector of the sixth transistor transmits a second current to the current mirror; and

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the current mirror is configured to produce the output current based on a difference between the first current and the second current.

3. The optoelectronic transceiver as recited in claim 1, wherein the optical transmitter comprises a laser diode.

4. The optoelectronic transceiver as recited in claim 1, wherein the second output voltage of the third stage is connected to and regulates a voltage controlled current source, the voltage controlled current source supplying the bias current as determined by the second output voltage.

5. The optoelectronic transceiver as recited in claim 1, wherein the reference voltage is set to the desired magnitude of the optical transmitter voltage.

6. The optoelectronic transceiver as recited in claim 1, further comprising a photodiode configured to detect an optical signal emitted by the optical transmitter.

7. The optoelectronic transceiver as recited in claim 1, further comprising an integrated circuit configured for communication with the postamplifier, driver and receive optical subassembly.

8. The optoelectronic transceiver as recited in claim 8, wherein the integrated circuit is configured to receive at least one of: a Loss of Signal signal; a Transmitter Fault Indication Signal; a Transmitter Disable Input signal; a Clock signal; and, a data signal.

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9. The optoelectronic transceiver as recited in claim 8, wherein the integrated circuit is configured to control the operation of, and receive operational information from, at least one of: the transmit optical subassembly; the driver; the receive optical subassembly; and, the postamplifier.

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10. A laser driver suitable for use in connection with a transmit optical subassembly that includes a laser diode, the laser driver comprising:

an input;

an output; and

an operational amplifier configured to communicate with the laser diode of the transmit optical subassembly by way of the output, and comprising:

a first stage including a differential amplifier configured to receive a reference voltage input and a laser diode voltage input and having a transconductance that increases exponentially as a difference between the reference voltage and the laser diode voltage increases, wherein the differential amplifier generates an output current based on the input, the laser diode voltage representing an optical output strength of the laser diode, the reference voltage corresponding to a desired magnitude of the laser diode voltage; a second stage including a capacitor, the second stage integrating the output current to generate a first output voltage; and

a third stage including an output buffer, the third stage configured to receive as input the first output voltage to generate a second output voltage approximately equal to the first output voltage, the second output voltage controlling a bias current for the laser diode.

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11. The laser driver as recited in claim 10, wherein:

the differential amplifier comprises a first transistor, a second transistor, a third transistor, a fourth transistor, a fifth transistor, and a sixth transistor;

a base of the first transistor is connected to the laser diode voltage, a collector of the first transistor transmits a first current to a current mirror, and the emitter of the first transistor is connected to a base of the second transistor, a first current source, and an emitter of the third transistor;

a collector of the second transistor is connected to a power supply voltage and an emitter of the second transistor is connected to a base of the fourth transistor and a second current source;

a collector of the third transistor is connected to ground and a base of the third transistor is connected to a third current source and an emitter of the fifth transistor;

a collector of the fourth transistor is connected to the ground and an emitter of the fourth transistor is connected to a fourth current source, a base of the fifth transistor, and an emitter of the sixth transistor;

a collector of the fifth transistor is connected to the power supply voltage;

a base of the sixth transistor is connected to the reference voltage and a collector of the sixth transistor transmits a second current to the current mirror; and

the current mirror is configured to produce the output current based on a difference between the first current and the second current.

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12. The laser driver as recited in claim 10, wherein the second output voltage of the third stage is connected to and regulates a voltage controlled current source, the voltage controlled current source supplying the bias current as determined by the second output voltage.

13. The laser driver as recited in claim 10, wherein the reference voltage is set to the desired magnitude of the laser diode voltage.

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14. An optoelectronic transceiver, comprising:

a receive optical subassembly;

a postamplifier in communication with the receive optical subassembly;

a transmit optical subassembly that includes an optical transmitter; and

a driver in communication with the transmit optical subassembly and comprising:

an input;

an output; and

an operational amplifier configured to communicate with the transmit optical subassembly by way of the output, and comprising:

a first stage including a differential amplifier, the first stage configured to receive as input a reference voltage and an optical transmitter voltage to generate an output current, the optical transmitter voltage representing an optical output strength of the optical transmitter, the reference voltage corresponding to a desired magnitude of the optical transmitter voltage, wherein a transconductance of the differential amplifier increases as a difference between the optical transmitter voltage and the reference voltage increases;

a second stage including a first capacitor and a charge switch, the second stage configured to integrate the output current produced by the first stage to produce a first output voltage, wherein a voltage comparator activates the charge switch when a difference between the optical transmitter voltage and the reference voltage is one of greater than and

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equal to a predefined amount such that a booster current is supplied through the charge switch to the output current;

a third stage including a second capacitor, the third stage configured to receive as input the first output voltage to produce a second output voltage approximately equal to the first output voltage, the second output voltage controlling a bias current for the optical transmitter; and

a set of switches including at least one fast loop switch and a slow loop switch for controlling a gain and frequency bandwidth of the operational amplifier, wherein a state of the at least one fast loop switch and a state of the slow loop switch determine whether the output current flows through the first capacitor or the second capacitor.

15. The optoelectronic transceiver as recited in claim 14, wherein the optical transmitter is in a linear operating range when the difference is less than the predefined amount.

16. The optoelectronic transceiver as recited in claim 14, wherein:

the charge switch comprises a first transistor and a second transistor;

a gate of the first transistor being connected to a voltage output of the voltage comparator, a drain of the first transistor connected to the second stage, a source of the first transistor connected to the current source and to a source of the second transistor;

a gate of the second transistor connected to a bias voltage and a drain of the second transistor connected to the ground;

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the bias voltage set such that when the voltage output of the voltage comparator indicates that the difference between the optical transmitter voltage and the reference voltage is one of greater than and equal to the predefined amount substantially all of the boosting current flows from the current source through the first transistor to the second stage; and

the bias voltage set such that when the voltage output of the voltage comparator indicates that the difference between the optical transmitter voltage and the reference voltage is less than the predefined amount substantially all of the boosting current flows from the current source through the second transistor to the ground.

17. The optoelectronic transceiver as recited in claim 14, wherein the reference voltage is set to the desired magnitude of the optical transmitter voltage.

18. The optoelectronic transceiver as recited in claim 14, wherein the optical transmitter comprises a laser diode.

19. The optoelectronic transceiver as recited in claim 14, further comprising a photodiode configured to detect an optical signal emitted by the optical transmitter.

20. The optoelectronic transceiver as recited in claim 14, further comprising an integrated circuit configured for communication with the postamplifier, driver and receive optical subassembly.

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21. An optoelectronic transceiver, comprising:

a receive optical subassembly;

a postamplifier in communication with the receive optical subassembly;

a transmit optical subassembly that includes an optical transmitter; and

a driver in communication with the transmit optical subassembly and comprising:

an input;

an output; and

an operational amplifier configured to communicate with the transmit optical subassembly by way of the output, and comprising:

a first stage including a differential amplifier, the first stage configured to receive as input a reference voltage and an optical transmitter voltage, the optical transmitter voltage representing an optical output strength of the optical transmitter, the reference voltage corresponding to a desired magnitude of the optical transmitter voltage;

a plurality of second stages, each of the plurality of second stages including a first capacitor and a second capacitor, one of the plurality of second stages producing a first output voltage from an output current produced by the first stage;

a third stage configured to receive as input the first output voltage to produce a second output voltage approximately equal to the first output voltage, the second output voltage controlling a bias current for the optical transmitter;

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a set of switches including at least one fast loop switch and a slow loop switch for controlling a gain and frequency bandwidth of the operational amplifier, wherein a state of the at least one fast loop switch and a state of the slow loop switch determines whether the output current flows through the first capacitor or the second capacitor; and

a voltage comparator to determine a difference between the optical transmitter voltage and the reference voltage, the voltage comparator controlling selection of the one of the plurality of second stages by reference to the difference between the optical transmitter voltage and the reference voltage.

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22. The optoelectronic transceiver as recited in claim 21, wherein the plurality of second stages include:

a slow second stage including the first capacitor; and

a fast second stage including a resistor in series with the second capacitor, the fast second stage providing comparatively greater gain than the slow second stage across a range of high frequencies.

23. The optoelectronic transceiver as recited in claim 22, wherein:

the voltage comparator is configured to select the fast second stage from the plurality of second stages when the difference exceeds a predefined amount; and

the voltage comparator is configured to select the slow second stage from the plurality of second stages when the difference is one of less than and equal to the predefined amount.

24. The optoelectronic transceiver as recited in claim 23, wherein the optical transmitter is not in a linear operating range when the difference is in excess of the predefined amount.

25. The optoelectronic transceiver as recited in claim 21, wherein the reference voltage is set to the desired magnitude of the optical transmitter voltage.

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26. The optoelectronic transceiver as recited in claim 23, further comprising:

an output of the voltage comparator being inverted and connected as a control signal to the first fast loop switch, an output section of a first of the plurality of second stages connected to the first fast loop switch as a current source, and a ground connected to the first fast loop switch as current drain for the first fast loop switch;

the output of the voltage comparator being inverted and connected as a control signal to a second fast loop switch, an output of a second output buffer connected to the second fast loop switch as a current source for the second fast loop switch, an input section of a second of the plurality of second stages connected to the second fast loop switch as a current drain for the second fast loop switch; and

the output of the voltage comparator being connected as a control signal to the slow loop switch, the slow loop switch connecting the first of the plurality of second stages to the output buffer;

wherein, when the output of the voltage comparator is set to a first level, the first of the plurality of second stages is the one of the plurality of second stages producing a first output voltage from an output current produced by the first stage and when the output of the voltage comparator is set to a second level, the second of the plurality of second stages is the one of the plurality of second stages producing a first output voltage from an output current produced by the first stage.

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